

WHAT IS CLAIMED IS:

[c01] 1. A method for reconstructing an internal surface geometry of a part, said method comprising:

registering a thickness map for the part with a plurality of external surface data for the part, the thickness map comprising a plurality of thickness data; and

generating a plurality of internal surface data using the thickness map and the external surface data.

[c02] 2. The method of claim 1, further comprising:

collecting a sequence of images of the part; and

generating the thickness map for the part from the sequence of images,

wherein said collecting and generating are performed prior to said registering.

[c03] 3. The method of claim 2, further comprising:

orienting at least one artifact relative to the part; and

determining an orientation of the artifact relative to a coordinate system of an imager,

wherein the images are of the part and the artifact, wherein the sequence of images are collected using the imager, and wherein the orientation of the artifact relative to the part remains substantially the same during said collecting step.

[c04] 4. The method of claim 3, wherein the artifact has a known geometry.

[c05] 5. The method of claim 3, wherein the orientation of the artifact relative to the coordinate system of the imager provides an orientation of the part relative to the coordinate system of the imager, and wherein said registering includes

using the orientation of the part relative to the coordinate system of the imager to register the thickness data to the respective external surface data.

[c06]           6.       The method of claim 5, further comprising generating an artifact thickness map for the artifact from the sequence of images, wherein said determining the orientation of the artifact relative to a coordinate system of the imager includes using the artifact thickness map and a plurality of external surface data for the artifact.

[c07]           7.       The method of claim 5, wherein said orienting of each of the at least one artifacts comprises:

selecting at least one datum on the part; and

attaching the artifact to the part at the at least one datum.

[c08]           8.       The method of Claim 7, further comprising determining a location of the artifact relative to each of the at least one datum, wherein said determining is performed for each of the at least one artifacts.

[c09]           9.       The method of claim 8, wherein said determining the location comprises mounting the artifact on a fixture arrangement to provide precision fixturing.

[c10]           10.      The method of Claim 8, wherein said determining the location further comprises measuring the location of the artifact relative to each of the at least one datum.

[c11]           11.      The method of Claim 7, wherein each of the at least one artifact comprises:

at least one land comprising a substantially planar surface and forming a respective face of the artifact; and

at least one wedge that is a substantially planar surface and forms a respective face of the artifact, wherein each of the at least one wedge intersects a respective one of the at least one land at an angle.

[c12] 12. The method of Claim 11, wherein each of the at least one artifacts further comprises at least one hole, and wherein said method further comprises aligning the artifact relative to the imager using the at least one hole.

[c13] 13. The method of Claim 11, wherein the artifact is positioned with one of the at least one lands facing the imager.

[c14] 14. The method of Claim 5, wherein the imager comprises an infrared ("IR") camera, said method further comprising irradiating the part and the artifact prior to collecting the sequence of images, wherein the thickness map is an IR thickness map.

[c15] 15. The method of Claim 14, wherein said irradiating comprises flashing the part and the artifact.

[c16] 16. The method of Claim 5, wherein said collecting comprises collecting the images for a plurality of views of the part.

[c17] 17. An inspection method for reconstructing an internal surface geometry for a part, said inspection method comprising:

obtaining a plurality of external surface data for the part;

collecting a sequence of images of the part using an imager;

generating a thickness map for the part from the sequence of images, the thickness map comprising a plurality of thickness data;

registering the thickness map with the external surface data; and

generating a plurality of internal surface data using the thickness map and the external surface data.

[c18] 18. The inspection method of claim 17, further comprising irradiating the part prior to collecting the sequence of images, wherein the thickness map is an IR thickness map.

[c19] 19. The inspection method of claim 18, further comprising:  
  
orienting at least one artifact relative to the part;  
  
generating an artifact thickness map for the artifact from the sequence of images, wherein the images are of the part and the artifact; and  
  
determining an orientation of the artifact relative to a coordinate system of the imager using the artifact thickness map and a plurality of external surface data for the artifact,

wherein the orientation of the artifact relative to the coordinate system of the imager provides an orientation of the part relative to the coordinate system of the imager.

[c20] 20. The inspection method of claim 19, wherein said orienting of each of the at least one artifacts comprises:

selecting at least one datum on the part;

attaching the artifact to the part at the at least one datum; and

determining a location of the artifact relative to each of the at least one datum, wherein said determining is performed for each of the at least one artifacts.

[c21] 21. The inspection method of claim 20, wherein each of the at least one artifacts comprises:

at least one land that is a substantially planar surface and forms a respective face of the artifact;

at least one wedge that is a substantially planar surface, intersects the land at an angle, and forms a respective side of the artifact; and

at least one hole,

wherein said method further comprises aligning the artifact relative to the imager using the at least one hole.

[c22] 22. The inspection method of claim 21, wherein the artifact is positioned with one of the at least one lands facing the imager.

[c23] 23. The inspection method of claim 21, wherein said collecting comprises collecting the images for a plurality of views of the part.

[c24] 24. An inspection system for reconstructing an internal surface geometry of a part, the inspection system comprising:

at least one artifact having a known geometry and a plurality of known dimensions;

at least one fixture arrangement for positioning said at least one artifact relative to the part; and

an imager for obtaining a plurality of thickness data of the part and the artifact.

[c25] 25. The inspection system of claim 24, further comprising at least one lamp for irradiating the at least one artifact and the part prior to obtaining the thickness data.

[c26] 26. The inspection system of claim 24, further comprising an external surface data monitor for obtaining a plurality of external surface data.

[c27] 27. The inspection system of claim 26, further comprising a computer for generating a plurality of internal surface data using a thickness map and a plurality of external surface data.

[c28] 28. The inspection system of claim 27, wherein said computer is further configured for generating the thickness map from the thickness data obtained

using said imager and for registering the thickness map to the external thickness data.